

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION

FENCE

(Feet)

CODE 382

Installation of Fence 382 shall adhere to the North Dakota NRCS conservation practice standard in the Field Office Technical Guide.

The General-Purpose Fence is designed to contain or control movements of livestock where heavy concentrations or pressures are not expected.

The Protective Fence is designed for uses such as excluding livestock from agricultural waste storage structures, spring development areas, portions of stockwater impoundments, seeps, critical area plantings, windbreaks, or other areas where a high degree of protection is desired.

The size, gauge, amount, weight, or type of materials specified for each fence type shall be regarded as minimums, unless otherwise specified. Post seating depths shall be regarded as minimums. Post spacing and wire spacing shall be regarded as maximums, unless otherwise specified.

All materials used in construction of a fence will be new. Any materials or construction features that exceed these specifications, or equivalents of different design but of equal or greater effectiveness, are acceptable for meeting specifications. Questionable materials or construction features require prior approval of the State Resource Conservationist.

GENERAL-PURPOSE FENCE

General-Purpose Fence (3 or 4-wire barbed, and woven-wire)

For construction details, see ND Conservation Job Sheet 13.

Materials

A. Barbed wire

1. Standard weight: Double-strand galvanized wire of 12.5 gauge with two-point 14 gauge wire barbs at a spacing of approximately 4 to 6 inches.
2. High-tensile strength (110,000 psi): Double-strand galvanized wire of 15.5 gauge with two-point 16.5 gauge barbs at a spacing of 4 to 6 inches.

B. Woven wire

1. Standard weight: 26 to 34 inches high netting with 11 gauge top and bottom wires, 14.5 gauge intermediate and stay wires, all galvanized. Mesh size can be 6" x 6" or 6" x 12"; 12-inch mesh is recommended for goats to reduce hang-up.
2. High-tensile strength: 42-inch netting with 12.5 gauge high-tensile strength (179,000 psi) line wires, 12.5 gauge medium-tensile strength (125,000 psi) stay wires, all galvanized. Mesh will be 4" x 6" to 7" x 12".

Conservation practice specifications are periodically updated. To obtain or verify the current version for this practice, contact the Natural Resources Conservation Service.

- C. Wood posts: All decay-susceptible wood posts (such as pine) must be treated with proper chemical preservatives for below-ground application (i.e. creosote or pentachlorophenol). Posts made from rot-resistant woods such as red cedar or Rocky Mountain juniper are suitable without treatment.
1. Line posts: 3-inch diameter, 6-foot length, sound, and reasonably straight.
 2. Corner, gate, and in-line brace posts: 5-inch diameter, 7-foot length, straight and sound, wood.
- D. Steel posts: Length, 5.5 feet; weight, 1.25 pounds per foot (excluding anchor plate); must have knobs, studs, or grooves for holding wire in place; must be equipped with a sturdy anchor plate firmly attached.
- E. Brace material
1. Braces: Straight and sound 4" x 4" x 8' lumber or 4-inch diameter post of 8-foot length or 2" x 8' galvanized steel pipe. Braces will be securely attached to the vertical posts.
 2. Wire: either of the following
 - a. Galvanized, double-strand 12.5 gauge
 - b. Galvanized, single-strand 9 gauge
- F. Wire fasteners
1. Staples: 9 gauge wire staples, 1.5 inches long for softwoods, 1-inch length for high-density hardwoods.
 2. Ties and/or clips: Made especially for the particular style of post used or #12 galvanized wire.
- G. Stays: Galvanized, twisted, wire stays shall be long enough to hold each fence wire at specified spacing.

Construction

- A. Post seating depth: All posts should be set deep enough to gain maximum sturdiness consistent with soil conditions. Set posts to the following depth under normal conditions:
1. Line posts
 - a. Wood: 2 feet
 - b. Steel: 1.5 feet
 2. Corner, in-line brace, and gate posts will be wood, seated at least 2.5 feet deep.

B. Line post spacing

1. Barbed-wire fence
 - a. Up to 24 feet without stays.
 - b. 25 to 30 feet with at least one stay. Stays must divide the space between posts about equally.
2. Woven-wire fence: Up to 20 feet.

C. Alignment: Construction should be as straight as possible between corners or turns. Fence construction along curved lines should be in straight segments with in-line bracing at appropriate angles. Sound railroad ties or 5" x 7' posts set at a depth of 2.5 feet are adequate for bracing many of these turns, especially where the angles are wide and the segment of fence is short.

D. Bracing and anchoring: When fencing over uneven terrain, the fence shall be adequately anchored at low spots.

1. In-line brace and end (gate) brace assemblies: Install at 1,320-foot intervals or closer, between corners or other major turns. Set two posts about 8 feet apart with top timber between the two, and diagonal wires from the base of each to the top of other posts.
2. Corner braces: Set brace a minimum of 8 feet from the corner with top timber between the posts, with one diagonal wire wrapped and twisted from the top of the brace post to the bottom of the corner post.

E. Wire placement: Wire will be double-wrapped and stapled at all corners, in-line brace post assemblies, and gate posts.

1. Barbed wire
 - a. Three-wire: Attach top wire at least 42 inches above ground level at post locations. Attach middle and bottom wires so wire-to-wire and wire-to-ground intervals are all about equal.
 - b. Four or more wire: Same as above, except operator may attach some wires closer together at their discretion, based on types of livestock involved.
2. Woven wire
 - a. Netting will be supplemented with a barbed wire attached approximately 3 inches above it. Attach bottom wire of netting about 2 inches above ground level at post locations.

Power Fence

For construction details, see ND Conservation Job Sheet 23.

Power fences erected in areas of potential high public use should be properly signed.

Wire

- A. Type: Use smooth, single-strand, 12.5 gauge high-tensile strength (170,000 psi, minimum), type III galvanized or better.
- B. Placement
1. A single, hot wire may be used in situations where the earth will provide an adequate ground to complete the circuit back to the energizer. This single, hot wire should be located 26 to 32 inches above the ground line.
 2. Two-wire power fences will have the top wire (hot wire) at least 26 inches above ground line and the bottom wire (ground wire) 4-8 inches below the top wire. The bottom (ground) wire will be connected either directly to the negative side of the energizer or to the same grounding rod(s) as the energizer. In situations where the earth provides an adequate ground to complete the circuit, both wires may be energized.
 3. Three-wire power fences will have the top wire (hot wire) at least 36 inches above ground line and the bottom wire (hot wire) approximately 18 inches above the ground line. Install the middle wire (ground wire) 10 inches above bottom wire. The middle wire (ground wire) will be connected either directly to the negative side of the energizer or to the same grounding rod(s) as the energizer. In situations where the earth provides an adequate ground to complete the circuit, all three wires may be energized.
- C. Tension: Tension on each wire shall be sufficient to maintain proper wire spacing between line posts. In-line strainers will be installed on each wire to maintain correct tension on each wire between all brace corners and gate assemblies. Tension springs may be used on each wire to maintain proper tension.

Line posts

- A. Material
1. Fiberglass posts will be a composite of marble, fiberglass, and polymer resin that has been treated by thermosetting (heat treatment). Posts will be a minimum of 1" x 1" T-shape or 1-inch diameter with notches or holes located for proper wire spacing.
 2. Wood posts will have a diameter of 2 inches or larger. Posts must be treated or made from rot-resistant wood. Eucalyptus wood (ironwood) and insul timber posts are not recommended due to excessive breakage.
 3. Steel posts will weigh one pound per foot, excluding anchor plate, and have a firmly-attached anchor plate.
- B. Placement requirements
1. Posts will be driven a minimum depth of 16 inches, except in sand where 24 inches may be required.
 2. For three-wire power fences, line posts are not to exceed 75-foot centers without stays, or 100-foot centers with stays on 50-foot centers between line posts.

3. For single-wire and two-wire power fences, line posts are not to exceed 100-foot centers. Stays should not be used on two-wire power fences.

Corner, Gate, and Brace Assemblies

- A. Materials and design will meet the same requirements as general-purpose fence.
 1. For one, two, or three-wire permanent power fences, the “Kiwi” style corner may be used in place of the standard H-style corner. Refer to ND Conservation Job Sheet 23.
 2. In-line brace assemblies will be spaced at intervals no greater than 4,000 feet on level terrain.
 3. Over uneven terrain, provide additional bracing as needed between corner, gate, end, and brace assemblies to put vertical pull of fencing on brace posts instead of line posts. Use properly anchored posts of adequate size with attached deadmen in low spots. On rises, use wood posts of 4-inch diameter or larger to counteract downward pull.

Fence Alignment

Construction should be as straight as possible between corners or turns. Construction along curved lines should be done in straight segments with in-line bracing at appropriate angles. Sound railroad ties or 5” x 7’ posts set at a depth of 2.5 feet are usually adequate for bracing these turns, especially where the angles are wide and the fence segment is short.

Fence Fasteners and Insulators

- A. Materials
 1. On wood posts and steel posts, use porcelain, ceramic, or high-quality, UV-stabilized polypropylene insulator to which the wire can be attached. Polypropylene insulators shall be of the type that provides adequate spacing from the post to prevent current leakage.
 2. Use only manufacturer’s recommended insulators at all points where tension from the wire is transferred to corner, gate, end, and brace posts.
- B. Attachment
 1. Attach wire to porcelain and ceramic insulators with the appropriate manufacturer’s clip or use 12 gauge, galvanized wire.
 2. Attach wire to fiberglass posts with the specifically designed manufacturer’s fastener or “clip” or use 12.5 gauge galvanized wire tied in a loop to attach wire to post. Instead of using “clips” or wire ties, holes may be drilled in fiberglass posts. Holes should be drilled at the proper spacing. The line wire is not to be threaded through pre-drilled holes but will be attached with wire or proper fasteners. High-tensile strength wire is attached to the post using a short length of galvanized wire that is looped around the line wire, threaded through the hole in the post, and wrapped back around the line wire on either side of the post (“Cotter key” style fastener).
- C. Stays: Only fiberglass stays will be used. They will be a composite of marble, fiberglass, and polymer resins that have been treated by thermosetting.

- D. Energizers: Electronic energizers or power-fence controllers shall be UL (Underwriters Laboratory) listed. Installation shall be according to manufacturer's recommendations. The maximum length of wire per controller shall not exceed manufacturer's recommendation for size and type of wire used. Controllers will have the following features/ meet the following minimum specifications:
1. High-power, low-impedance with 5,000-volt peak output, a pulse that is finished within 1/3000 of a second, and 54-60 pulses per minute.
 2. High-impact, weather-resistant cases.
 3. Solid-state circuitry (snap-in circuit panels).
 4. Lightning arrester.
 5. Safety-pace fuse.
 6. Any of the following power requirements;
 - a. 110-volt
 - b. 220-volt
 - c. 12-volt battery-powered, capable of working three weeks without recharge.
- F. Electrical Grounding: All power fences must be properly grounded as per the energizer manufacturer's recommendation. Inadequate grounding is the leading cause of power fences' failure to control livestock.
- G. Insulated cable: To cross gates and other areas where the power fence is located some distance away from the energizer or controller, use insulated cable. Use galvanized wire with two layers of insulation for underground burial or overhead transmission. Where feasible use overhead transmission to reduce the incidence of short-circuiting, which can occur with underground burial. Do not use copper, insulated wire due to corrosion factor and lack of tensile strength.

PROTECTIVE FENCE

For details, see ND Conservation Job Sheet 14. Construct standard protective fences by the same method and design as specified for general-purpose fence except for the following variations:

Materials

A. Line posts

1. Wood: 4-inch diameter, length 6.5 feet
2. Steel: 6-foot length, weight of 1.25 pounds per foot, excluding anchor plate

Construction

A. Line post spacing

1. 16 feet; wood at least every third post: applicable for barbed and woven-wire protective fence
- B. In-line bracing and anchoring
1. Maximum 825-foot interval.
- C. Wire
1. Four barbed wires with top wire at least 42 inches above the ground. Lower wires to be spaced at the discretion of the operator, based upon types of livestock to be excluded.
 2. Woven wire will have at least one barbed wire attached approximately 3 inches above the top of the woven wire.

CHAIN-LINK FENCE

For use as protective fence where high-hazard risks need to be reduced (i.e., around waste storage structures, power generators, etc.).

Materials

- A. Wire
1. Fabric wire will be a minimum of 12.5 gauge 2-inch mesh, 48 inches high, with zinc coating or equivalent.
 2. Barbed wire; See general-purpose fence design section for barbed wire specifications.
- B. Posts
1. Line posts: galvanized steel with a minimum outside diameter of 1 $\frac{5}{8}$ " x 5.5'.
 2. Corner posts: galvanized steel with a minimum outside diameter of 2 $\frac{3}{8}$ " x 6'.
 3. Gate posts: galvanized steel with a minimum diameter and length to support the gate width needed according to the manufacturer's recommendations.
- C. Top rail
1. Will be galvanized steel pipe, or equivalent, with a minimum diameter of 1 $\frac{5}{8}$ inches.
- D. Gates
1. Gates will be of the size necessary to allow for equipment access.
 2. Gates shall be installed according to manufacturer's recommendations.
 3. Gates may be single-swing or double-swing with the appropriate fittings for latches, stops, hinges, keepers, and other needed accessories. All materials will be steel with zinc coating or equivalent.

E. Chain-link fence accessories

1. Caps, rail and brace ends, rail sleeves, wire ties and clips, brace bands, tension bands, tension bars, tension wire, barbed-wire support arms, and other accessories will be of steel and zinc coated as per manufacturer's recommendations. Install lock, latches, or chains where safety is a concern.

Construction

All chain-link fences will be constructed according to the manufacturer's recommendations and/or completed job sheets.

FENCE DESIGN FOR SPECIALIZED LIVESTOCK/OTHER ANIMALS

Bison

- A. Boundary fences: The specification for a standard protective fence will be used as the minimum design criteria for a boundary fence. Six-foot length, steel posts will be utilized in place of the standard 5.5-foot length, steel post. Wood posts will be 6.5 feet in length. Top wire should be set at 52 inches in height.
- B. Internal cross fences: The minimum design criteria are a standard three-wire barbed or two-wire power fence. Fences exceeding minimum criteria will be dependent on producer's need and management.

Elk

Elk fence design: For specific requirements, refer to North Dakota Century Code: General Authority 36-25-02; Law Implemented 36-25-05; Article 48-14-01-05. This information can be acquired from the North Dakota Department of Agriculture's Board of Animal Health. This section is subject to change with amendments to North Dakota Century Code. The Century Code Web address is www.discovernd.com/government/statelaws.html

Horses

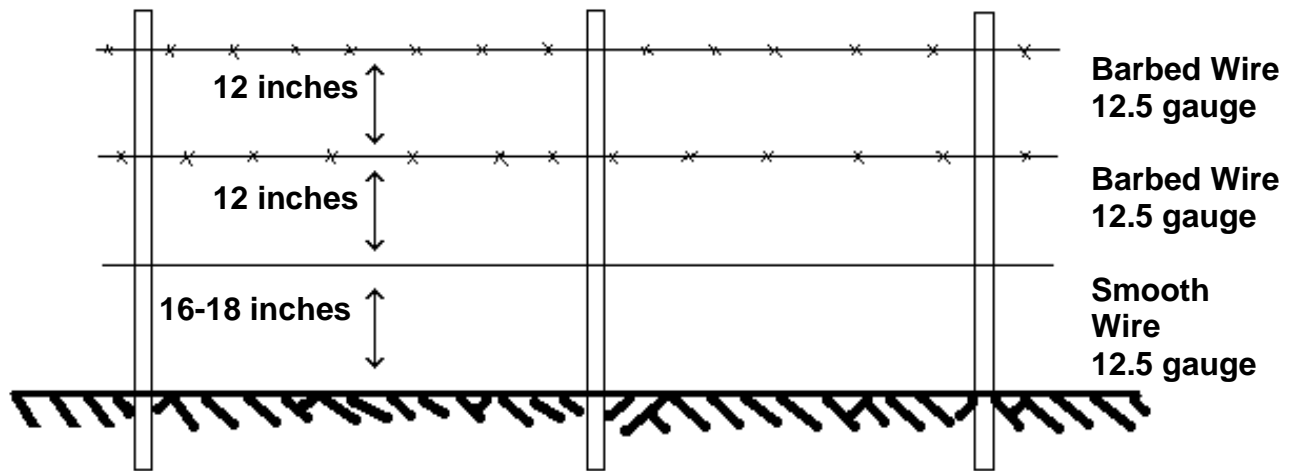
To minimize or prevent injury; double-strand, galvanized, barbless wire of 12.5 gauge may be substituted for the barbed wire in a general-purpose or protective fence.

Antelope Crossing

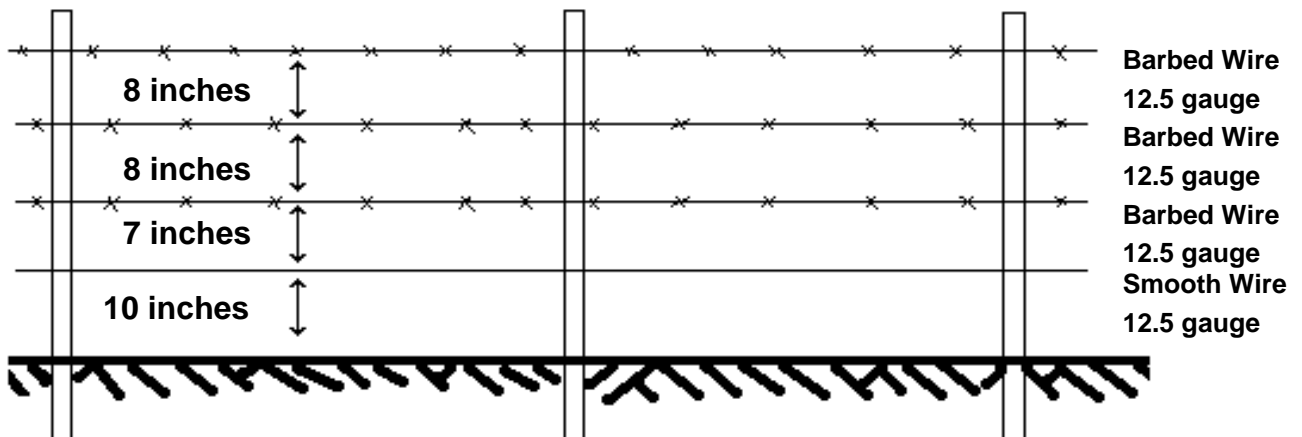
Antelope seldom jump over or go through a fence, but will crawl underneath the fence. The adequate height for an antelope to crawl under is 16-18 inches. Wire spacings are different for cattle and sheep. These fences can be installed in full-length sections or in sections where antelope typically cross. See Diagram #1 Antelope Crossing.

Diagram # 1 Antelope Crossing

Cattle Fence with Antelope Crossing



Sheep Fence with Antelope Crossing



REQUIRED FORMS

- A. ND-CONS-2 Fence Data Sheet

OPTIONAL DOCUMENTS

- A. Manufacturer's instructions for power fence energizer

PLANNING REQUIREMENTS

- A. Document compliance with NRCS' cultural resource policy and environmental policy.
- B. Indicate the location of fence on the conservation plan map.
- C. Furnish the operator with the Conservation Job Sheet(s) for each type of fence planned.
 - 1. ND Conservation Job Sheet 13 for Permanent Electric Fence
 - 2. ND Conservation Job Sheet 14 for General Purpose Fence
 - 3. ND Conservation Job Sheet 23 for Protective Fence
- D. For chain-link fence, include a copy of the manufacturer's recommended specifications in the case file.

PERFORMANCE

- A. Field check a representative sample or all fencing for conformance to material and construction specifications.
- B. Identify sections of the fence checked.
- C. Determine the length of the fence by chaining or plotting and measuring on an aerial photo. The latter is to be used only when the location can be readily and accurately plotted.
- D. Accept producer-claimed figure when aerial photo measurement is used and difference is minor. Resolve any major difference by chaining.
- E. Complete all data on form ND-CONS-2 Fence Data Sheet.